US Army Corps of Engineers®
Albuquerque District

FINAL ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF A LOW-HEAD WEIR, RIO JEMEZ, THE PUEBLO OF SANTA ANA, NEW MEXICO

U.S. Army Corps of Engineers
Albuquerque District
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CONVERSION FACTORS

	From	Multiplier-->	To
Length	inches	25.4	millimeters
	feet	0.3048	meters
	miles	1.6093	kilometers
Area	acres	0.407	hectares
	square miles	2.590	square kilometers
Volume	cubic yards	0.7646	cubic meters
	acre-feet	1233.5	cubic meters
	acre-feet	325,851	gallons
Flow	cubic feet/second (cfs)	0.0283	cubic meters/second
Mass (weight)	tons (short ton)	0.9072	metric tons
Velocity	feet/second	0.3048	meters/second
Salinity	µSiemens/cm or µmhos/cm	0.32379	parts/million NaCl or mg/liter NaCl
Temperature	° Fahrenheit	(°F-32)/1.8	° Celsius

Scientific (Latin) names of all species referred to by common names in the body of this document are given in Appendices A-F.

ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED LOW-HEAD WEIR CONSTRUCTION, RIO JEMEZ, THE PUEBLO OF SANTA ANA, NEW MEXICO

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1. INTRODUCTION

1.01 LOCATION AND BACKGROUND

The Rio Jemez originates in the Jemez Mountains of New Mexico, converges with the Rio Grande north of Bernalillo, and is entirely situated in Sandoval County, NM. The proposed project vicinity map is shown on Figure 1 and the project site map is shown on Figure 2. The proposed project site would be located approximately 2.5 miles upstream of Jemez Canyon Dam on land held in trust by the United States for the benefit and use of the American Indian people of the Pueblo of Santa Ana.

The Rio Jemez flows in a generally southeasterly direction with a total length of approximately 65 miles. Elevation ranges from over 11,000 ft. at the headwaters of the watershed to 5,075 at the confluence with the Rio Grande. The river is perennial in the upper reach and ephemeral in the lower reach above the Jemez Canyon Reservoir due to irrigation diversion upstream. The Rio Jemez in the project area has an elevation of 5,120 ft. The project site is located on the Santa Ana Pueblo USGS 7.5 minute topographic quadrangle.

The U.S. Army Corps of Engineers (Corps) and the Pueblo signed an MOU in 1952 (amended in 1978 by P.L. 95-498) which established a perpetual right and privilege for the construction, operation, and maintenance of the Jemez Canyon Dam and Reservoir Project. The facility was subsequently built and put into service in 1953 with the intention of regulating Rio Jemez flows for flood damage reduction and sediment retention. The Pueblo of Santa Ana reserved the right to use all associated lands for any purposes not inconsistent with those expressly granted to the government for the facility. Prior to dam construction, aerial photography taken in 1935 showed that the Rio Jemez in the proposed project area was typically a sand-bedded, low gradient channel. The only constraints to active meandering were valley walls and alluvial fan and debris deposits along the valley wall edges. During dam construction, the Corps established sediment and channel aggradation and degradation monitoring transects upstream and downstream of the dam (Figure 3).

Rio Jemez flows have typically passed through Jemez Canyon Dam with little, if any, regulation. Reservoir releases were typically restricted to the maximum non-damaging capacity of the downstream channel of the Rio Grande, as measured at Albuquerque, up to 7,000 cfs (USACE 1994). When the passage of inflow to the reservoir has exceeded the channel capacity of the Rio Grande downstream, flood control storage has been initiated. Flood waters have been stored only for the duration needed to evacuate the water as rapidly as downstream conditions permit. Operation of Jemez Canyon Dam for flood control is coordinated with Cochiti and Galisteo Dams in order to regulate for the maximum safe flow at Albuquerque. Deviations from the existing water control plan which are not deemed an emergency require approval by South Pacific Division of the Corps and (except for San Juan Chama Project water) concurrence by each of the Rio Grande Compact Commissioners.

The Jemez Canyon Reservoir pool area for flood and sediment control is approximately 6 miles long and 1 mile wide and encompasses the proposed project site. Initial capacity allocations were 73,000 acre-feet for flood control and 44,000 acre-feet for sediment deposition. As of June 1998, approximately 19,000 acre feet of sediment had accumulated behind the dam.

Flood storage is normally associated with snowmelt runoff during March through June. Summer flood storage is generally the result of short-term, high intensity thunderstorm events. The maximum storage to date has been 72,254 acre-feet (elevation 5,220.3 feet), occurring in 1987.

In the spring of 1979, the Corps and the New Mexico Interstate Stream Commission (NMISC) established a sediment retention pool of about 2,000 acre-feet at Jemez Canyon Reservoir using water exchanged from the San Juan-Chama Project. In January 1986 the sediment retention pool was expanded to include the entire unused capacity of the allocated sediment space to further improve trap efficiency of the reservoir. The water for this expansion (up to a maximum sediment retention pool capacity of 24,425 acre-feet) was again obtained through exchange for water currently at the San Juan-Chama Project leased from the City of Albuquerque by the NMISC. The pool was created and maintained by capturing native water from the Rio Jemez in the reservoir and replacing that water to the Rio Grande by releasing San Juan-Chama Project water from upstream storage, usually during the spring runoff period. Thus, a pool existed without interruption at Jemez Canyon Reservoir since 1979.

Subsequent to the creation of a sediment pool at the reservoir, the effect of groundwater-surface water interaction in the upstream delta area allowed vegetation growth that narrowed the traversing channel. Vegetation growth just upstream of Rangeline 4 to the Tamaya Bridge provides more bank structure and overbank flow resistance that constrains the channel and causes the channel to divide. Downstream of Rangeline 4 and the vegetated delta and subsequent to the evacuation of the sediment pool, channel width and meander width has expanded, with the potential meander width covering the entire valley bottom similar to pre-dam, pre-pool conditions (Data Collected by Pueblo Consultants).

The Corps and the NMISC storage agreement expired on December 31, 2000, the MOU's original expiration date. The NMISC decided not to extend the agreement for sediment pool storage, citing significantly increased demands on available water in the region, its increasing cost, and the need for increased sediment loading to the currently degrading Rio Grande channel as factors in this decision. A partial evacuation of the pool began on September 20, 2000. The pool at Jemez Canyon Reservoir was finally evacuated by October 2001. Subsequently, the Corps and the Pueblo of Santa Ana have formulated a mitigation plan with an array of alternatives to address the onset of channel incision of the Rio Jemez resulting from evacuation of the sediment pool at Jemez Canyon Reservoir.

1.02 PURPOSE AND SCOPE OF THE PROPOSED PROJECT

During the fall of 2000, consultants to the Pueblo began monitoring channel incision promulgating as a result of the pool drawdown. By July 2001, knick points on the Rio Jemez channel had progressed approximately 5,200 ft. upstream, and volume of sediment moved as a result of the progressing incision was estimated at 380,000 cubic yards (Data Collected by consultants to the Pueblo 2001). Consultants to the Pueblo attempted to model channel incision following pool evacuation using HEC-6 erosion and sediment transport software. The model predicted an incision of 4-7 ft. in the vicinity of Rangeline R-4, occurring over 1-4 years, depending on Rio Jemez flows. Upstream of R-5, channel incision was predicted to be 2-3 ft. The survival of a bosque of mixed Rio Grande cottonwood, coyote willow, saltcedar, sedges, bulrushes, and rushes above R-4 is threatened by channel incision and the resulting effects of declining or lowered surface and subsurface water, reduced overbank inundation and decreased soil moisture.

Continued channel incision would likely affect approximately 390 acres of riparian bosque of mixed native and exotic species along the Rio Jemez delta on lands owned by the Pueblo of Santa Ana. The effect would be a lowered groundwater table below the uptake capabilities of native riparian obligate tree species. Such a consequence would likely result in further colonization of non-native salt cedar,

Russian olive and Siberian elm trees and brush in the delta bosque. Habitat quality and quantity for the federally endangered Southwestern Willow Flycatcher, the warranted but precluded Western Yellow-billed Cuckoo, and other riparian obligate bird, mammal, reptile and amphibian and plant species would be lost as a consequence of future channel degradation. This Environmental Assessment (EA) examines the no-action and remedy alternatives proposed by the Corps and the Pueblo of Santa Ana and recommends a preferred alternative to minimize channel degradation and decline of groundwater elevation.

1.03 RELATIONSHIP TO OTHER ACTIONS

The proposed action is related to mitigation for the evacuation of the Jemez Canyon Reservoir sediment pool and to the future action of draining the Tamaya Pond (inadvertently created from past levee construction), future modification of the Jemez Canyon Dam outlet works, and future adaptive management of the former pool area and adjacent delta lands.

1.04 REGULATORY COMPLIANCE

This EA was prepared by the Corps in compliance with all applicable Federal statutes, regulations, and Executive Orders, including:

American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996)
Archaeological Resources Protection Act of 1979 (16 U.S.C. 470)
National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 *et seq*.);
Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500 *et seq*.);
U.S. Army Corps of Engineers' Procedures for Implementing NEPA (33 CFR 230);
Clean Air Act of 1972, as amended (42 U.S.C. 7401 *et seq*.);
Clean Water Act of 1972, as amended (33 U.S.C. 1251 *et seq*.);
Endangered Species Act of 1973 as amended (16 U.S.C. 1531 *et seq*.);
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, 1994.
Fish and Wildlife Coordination Act of 1934 as amended (48 Stat. 401 as amended; 16 U.S.C 661 *et seq*.)
Protection of Wetlands (Executive Order 11990).
National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 *et seq*.);
Protection of Historic Properties (36 CFR 800 *et seq*.);
Protection and Enhancement of the Cultural Environment (Executive Order 11593);
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 *et seq*.).

This document and associated analyses were coordinated in consultation with the Pueblo of Santa Ana.

2. DESCRIPTIONS OF THE NO-ACTION ALTERNATIVE AND THE PROPOSED PLAN

2.01 BACKGROUND FACTORS COMMON TO BOTH ALTERNATIVES

The following sections describe the basic scenarios of bosque protection and the prevention of channel headcutting on the Rio Jemez and associated delta under the no-action and proposed alternatives.

Relevant to all alternatives is the fact that the expiration of the sediment pool agreement and the cessation of water impoundment for sediment control will not terminate the authorized purposes or operation of Jemez Canyon Dam for sediment and flood control. The facility will continue to operate to achieve the stated purposes. Further, there is the future possibility that a sediment pool might be reinstated by the Pueblo of Santa Ana and the Corps or in collaboration between the Pueblo, the Corps, and other governmental entities.

2.02 NO-ACTION ALTERNATIVE

This alternative would consist of no action undertaken by the Corps and the Pueblo of Santa Ana. No remedy to the active channel incision ongoing upstream of the former sediment pool of the Jemez Canyon Reservoir and Dam would be pursued. Channel morphology of the Rio Jemez would reach a new equilibrium, and adverse consequences (lowered groundwater, reduced overbank inundation and decreased soil moisture) to existing riparian plant and animal habitat of the Rio Jemez delta from inevitable channel incision would be accepted by the Pueblo of Santa Ana.

2.03 PROPOSED PLAN

The primary objectives of the proposed plan are to construct a series of grade control structures to arrest river channel degradation and subsequent loss of overbank flooding and dewatering of root zones of native and exotic riparian and wetland plant species and the animal habitat they provide, as a result of channel incision.

To accomplish this end, the Corps and the Pueblo of Santa Ana propose a series of four interlocked polyvinyl chloride (PVC) sheetpile weirs. The weir would be oriented roughly perpendicular to the Rio Jemez channel, approximately 2.5 miles upstream of Jemez Canyon Dam. The suggested weir design has a series of 4 vertical drops where the river thalweg will drop a total vertical distance of 14 ft. A 25-ft. long downstream horizontal impact zone of wire-enclosed rock would be placed below each sheetpile weir. The lateral extent of the first vertical drop would be across the entire width of novnvegetated channel, with successive drops increasing uniformly in extents at 45 degrees. Only the second row of sheet piling would be extended to high ground on each side of the river. The top of the second row would increase in incremental one-foot high steps. Stair-stepped configuration of the second row of sheet piling is meant to induce over bank flows towards the center of the weir structure. Two additional sheet-piling rows would extend diagonally from second row to the third and fourth row along created slopes. These diagonal rows of sheet piling are intended to add stability to wire enclosed rock protection set on slope and to divert flow back towards center of weir structures.

Two wing dikes would be constructed, one on each side of the river channel on the upstream side of the weir to maintain higher peak flows within the existing channel. The wing dikes would be earthen berms, covered in rock armor, with a maximum height of about two ft. above the height of the weir. The dikes would be approximately 435 ft. long, flaring out from each bank in the upstream direction. The Corps has conducted a hydraulic analysis study to justify this design.

The rock for the wire-enclosed aprons and wing dike armor would be removed from an existing basalt quarry located on Pueblo of Santa Ana land in the vicinity of the dam site. Rock would be extracted with explosive charges, then crushed and stockpiled at the quarry site.

A staging area, not to exceed two acres, would be provided for the contractor's use during the construction phase of the project. Construction limits of 50 ft. upstream of the weir and 200 ft. downstream of the weir would be established around the perimeter of the project to prohibit any unnecessary destruction of habitat. The project site would be accessed via an existing four-mile-long two-track road originating from U.S. Hwy 550 (Figure 2). This access road would be improved with accepted rural road best management practices to accommodate heavy vehicular traffic while minimizing soil erosion, maintaining water quality standards, and protecting other natural/cultural resources.

Final design of the weir would be accomplished by August 6, 2003, and construction would be performed during August, 2003 through March, 2004. The staging area (two acres) and construction corridor (22.4 acres) and any other upland areas disturbed by construction activities would be revegetated with native plant species after construction is completed, as soon as temperature and moisture conditions allow. Howevr, species selection and planting density will be tempered by the potential for fuel accumulation near the weir, which if ignited, could destroy or damage the weir.

3. EXISTING ENVIRONMENT
RIO JEMEZ DELTA AND RESERVOIR POOL AREA

3.01 GEOLOGY

The Rio Jemez delta is located entirely within an outcrop of the Santa Fe formation, a Miocene-Pliocene series of the Tertiary system (USDA Soil Conservation Service et al.1977). In the immediate area of the dam and well above the dam height, the Santa Fe formation is overlain by a basalt cap of Quaternary age. Within the delta area there is a minimal amount of basalt talus. The Santa Fe formation is composed of clay, silt, sand, gravel, and cobbles. The formation at the site is generally horizontally bedded; however, the beds are discontinuous both vertically and horizontally.

3.02 SOILS

Although the proposed project site has not been surveyed by soil scientists of U.S.D.A., by interpolation from other data collected on similar sites off Pueblo lands, one primary soils association is found in the Rio Jemez delta. Christianburg-Navajo soils occur principally along the floor of the Rio Jemez valley (USDA Soil Conservation Service et al.1977). They are nearly level, fine-textured alluvium weathered from shale and sandstone and are highly susceptible to erosion. These soils encompass nearly the entire flood pool area of the reservoir and floodplain upstream of the pool area (*i.e.*, below elevation 5,232 feet).

3.03 CLIMATE AND HYDROLOGY

Climate of the Rio Jemez Basin is characterized by hot summers with a large diurnal range in temperature. Winters vary from moderate in the lower basin to severe in the higher mountainous area. The spring and fall transition seasons are usually very short. Change from summer to winter is characterized by the disappearance of thunderstorm activity followed by clear weather which dominates

between winter frontal passages. During the summer, northern New Mexico has a higher frequency of thunderstorms than most areas in the United States. Monsoon thunderstorms are most active during July and August and usually reach peak activity in late afternoon.

The average annual precipitation over the Rio Jemez Basin, based on National Weather Service stations in and adjacent to the basin, is approximately 17.0 inches based on data from 1914-2001 compiled by Western Regional Climate Center, Desert Research Institute (2002). The Jemez Springs rainfall station recorded a maximum annual precipitation of 28.72 inches in 1957 and a minimum of 6.17 inches in 1956. The maximum recorded 24-hour rainfall was 3.24 inches on October 5, 1911. Since the installation of the weather station at Jemez Canyon Dam in 1954, the maximum annual precipitation was 13.88 inches in 1987 and the minimum was 2.40 inches in 1956. The maximum recorded 24-hour rainfall was 2.75 inches on October 17, 1960. Mean annual precipitation in the Rio Jemez Basin varies from 8.35 inches at Jemez Canyon Dam to more than 30 inches in the high mountainous regions of the basin. About one-third of the annual precipitation occurs during July and August as thunderstorms.

During the winter months, heavy snowfall occurs in the upper mountainous areas of the watershed and snow is light over the lower basin. Snow remains in the mountainous areas above 7,000 ft. elevation from December into April. Below 7,000 feet in elevation, snow seldom stays on the ground more than a few days. The average annual snowfall varies from 10 inches at Jemez Canyon Dam to over 100 inches in the mountains.

Four notable floods have occurred since the Jemez Canyon Dam was completed in 1953 and the project began operation (Table 1). Summer or fall floods of significant magnitude have not occurred during project operation.

Jemez Canyon Reservoir reached a record pool elevation on June 2, 1987. Flood control storage starting on 13 April resulted in a maximum elevation of 5,220.3 feet (72,254 acre-feet).

Table 1. Highest Rio Jemez Inflows Recorded at Jemez Canyon Dam and Reservoir Project, the Pueblo of Santa Ana, NM.

Date	Peak inflow (cfs)
June 8, 1958	3,350
May 27, 1973	2,000
May 2, 1979	1,282
June 2, 1987	1,242

In the Rio Jemez Basin, runoff response to precipitation is very rapid due to steep slopes, resulting in floods with very high peak flows. Flood volumes are usually small due to an interaction between the areal extent of the watershed and the temporal and areal nature of a storm event. The mountain streams are narrow and steep so flow rises very rapidly and falls rapidly after the peak passes. The Rio Salado channel in the lower reaches and the Rio Jemez channel below the Rio Salado confluence are wide and sandy with a shallow, braided flow pattern that results in rapid attenuation of floods with high peaks and small volumes. The mountains, due to the vegetal cover, have relatively high evapotranspiration loss rates of 0.5- to 1.0-inch per hour. This, along with significant depression storage in the valleys, greatly reduces runoff. The mesas have flatter slopes, grass and herbaceous cover, and large playas that reduce runoff. Mesa loss rates vary from 0.2 - to 0.5-inch per hour. The area generally below an elevation of 6,000 feet is covered by semi-arid desert vegetation and has the lowest loss rates (0.1 - to 0.3-inch per hour) due to the scarcity of vegetation and soils with high clay content. Summer thunderstorms with their very high intensity precipitation and short duration often result in 80% or greater runoff from this area. Spring runoff from snowmelt during March through June produces most of the

annual runoff volume. Sixty percent of the flow occurs in April and May from the winter snowpack accumulation. Thirty-four percent of annual precipitation occurs as summer thunderstorms in July and August.

The mountain streams are perennial with high flows in the spring or immediately following a storm. Summer, fall, and winter flows are very low and clear. The Rio Jemez is usually dry during the summer at the Rio Salado confluence (south of San Ysidro) due to upstream irrigation diversions and evapo-transpiration. Most streams below 7,000 feet in elevation are intermittent and flow only following precipitation that exceeds infiltration and evapo-transpiration losses.

3.04 GEOMORPHOLOGY

The total area drained by the Rio Jemez is 1,038 square miles, with 1,034 square miles above the dam. The watershed is about 65 miles long with a maximum width of 30 miles. The terrain rises from elevation 5,120 feet at the dam to over 11,000 feet in the mountainous region of the headwaters in the Jemez Mountains. The stream channel in the upper reach is confined within narrow canyons. The stream meanders through a broad sandy valley in the lower reaches and through the reservoir area which is several hundred feet wide without well-defined banks. Below the dam the river enters a narrow canyon, which extends to the confluence with the Rio Grande. Stream slopes vary from 0.3% at the dam to greater than 4.7% in the mountains.

The Rio Jemez at the project impact area can be classified as a Rosgen D5 stream type (Rosgen 1996). A D5 river/stream is characterized by braided streams within a broad alluvial valley and an alluvial fan consisting of deposited sand-sized material. Channel bed materials are predominantly sand with interspersed amounts of silt/clay materials on deltas. The braided channel system is characterized by high bank erosion rates, excessive deposition occurring as both longitudinal and traverse bars, and annual shifts of bed location. Bed morphology is characterized by a closely spaced series of rapids and scour pools formed by convergence/divergence processes that are very unstable. A combination of conditions are responsible for channel braiding, including high sediment supply, high bank erodibility, and very flashy runoff conditions which can vary rapidly from a base flow to an over-bank flow on a frequent basis (Rosgen 1996).

The principal mountain tributary of the Rio Jemez is the Rio Guadalupe, which enters the river about 26 miles upstream from the dam. It originates in the Jemez Mountains and is perennial. Coniferous forest, interspersed with groves of aspen, covers the watershed above 7,000 feet. Vegetal cover in the lower elevations includes pinyon pine, juniper, and oak brush with very sparse grasses and forbs. The upper area is characterized by steep slopes varying from 250 feet per mile to 130 feet per mile, which results in rapid runoff.

The principal tributary in the lower basin is the Rio Salado, an ephemeral stream, which drains the southwest portion of the Rio Jemez Basin. It originates in the lower mountain region and flows through the highly erodible, low-lying plateau area of the watershed. Vegetal cover is sparse and consists of short grass and desert shrubs. Slopes in this area vary from about 2.5% at higher elevations to 0.3% along the Rio Jemez delta. Because of the nature of the soils and plant cover, the lower area is much more conducive to runoff than the upper area. The Rio Salado-Rio Jemez confluence is near San Ysidro about 17 miles upstream from the dam.

3.05 SEDIMENTATION

The Rio Jemez above its confluence with the Rio Salado at San Ysidro has a drainage area of about 600 square miles. From sediment sampling records between February 1937 and June 1941, suspended sediment passing San Ysidro was approximately 400 acre-feet per year and the average concentration for all months of record was 0.46% sediment by weight. Some sediment was diverted into irrigation ditches at San Ysidro. No known sediment samples were secured from this location between 1941 and 1975 (USACE 1975).

The Rio Salado has a drainage area of about 251 square miles, most of which is plateau with rough, broken and hilly terrain, and is easily eroded. For about three miles above San Ysidro, the streambed is wide and sandy. Sediment sampling on this stream showed that the sediment load was about 150 acre-feet per year including 15 acre-feet of bedload. Records of sediment sampling from the Rio Jemez at Zia Pueblo, about five miles below the Jemez-Rio Salado confluence, show an average annual suspended sediment load of about 500 acre-feet per year (USACE 1994).

Below San Ysidro, the characteristics of Rio Jemez suddenly change. The slope becomes flatter and the streambed becomes wider and is plugged with sand and fine material, which is washed into the river from tributaries and aeolian deposition. The 183 square miles of drainage area between Jemez Dam and San Ysidro produces about one-half of the total sediment entering the reservoir area. Most of the sediment comes from the south side of the Rio Jemez where the Santa Fe formation is exposed or is covered with a mantle of wind-blown alluvium. The surrounding area is sparsely vegetated. The terrain consists of rolling hills cut by numerous steep-sided arroyos. Near the river extensive dunes have advanced to the edge of the stream in some places. Runoff from this area discharges large quantities of sediment into the river. The suspended sediment load entering the reservoir area was estimated to be about 910 acre-feet per year and the bed load about 10% of the suspended load for a total of about 1,000 acre-feet per year. Approximately 60% of the total yearly runoff occurs during the spring runoff period and about 70% of the total suspended sediment load occurs during this period (USACE 1994)

The transport and deposition of sediment, which affect the operation of Jemez Canyon Dam and Reservoir Project, are monitored by the measurement of suspended sediment concentrations of reservoir outflow and by periodic ground and hydrographic surveys of the reservoir area. Thirteen transverse sediment ranges were installed in Jemez Canyon Reservoir in 1952 and marked with concrete monuments (Figure 3). Each range was numbered and profiled. Ranges 10 through 13 are located above the maximum water surface of the reservoir for the purpose of determining channel changes and aggradation or degradation of the river channel. Ranges 1 through 9 are used to determine the amount of sediment deposition that has taken place in the reservoir area. Sedimentation resurveys are normally scheduled on a five to seven year basis. Resurveys at Jemez Canyon Reservoir were conducted in August 1959, December 1965, January 1975, December 1983, June 1991, and June 1998.

According to a Corps 1998 longitudinal reservoir profile survey, the apparent extent of upstream influence of sediment deposition on the channel is around Range Line R-9, just upstream of the bridge to the old the Pueblo of Santa Ana. There is reason to believe that this bridge causes deposition to be greater in this immediate area, but deposition has also been affected by the presence of Jemez Canyon Dam (USACE 1975). Deposition also occurs at Rangeline R-5 where a large arroyo enters from the south, and at Rangeline R-4 where the mean pool elevation since 1986 has occurred.

3.06 GROUNDWATER

Groundwater has been monitored along the Rio Jemez delta on lands of the Pueblo since January, 2001 by the Pueblo's Department of Natural Resources staff and consultants. Piezometers were installed at various depths and reveal that groundwater depths tend to be relatively shallow throughout the year; the depths were greatest in late summer, and shallowest during winter and spring. The shallowest groundwater occurs between the old Tamaya Pueblo (equivalent to Rangeline R-8) and R-5.

Consultants to the Pueblo determined that during 2001 above Rangeline R-4, the local shallow groundwater flow system is largely controlled by the regional groundwater flow system and the Rio Jemez. Below Rangeline R-4, the local shallow groundwater flow system was largely controlled by the regional groundwater flow system and Jemez Canyon Reservoir. The observed groundwater backwater effect caused by Jemez Canyon Dam did not extend much above Rangeline R-4 but could extend to Rangeline R-5A. The highest groundwater effect between R-8 and R-5A may be sustained by the natural constriction at R-5 more than by the reservoir.

During construction of the Pueblo of Santa Ana levee, about 1.5 miles upstream of the proposed project site, pumps were installed to remove water from the interior of the levee. Since the establishment of the 1986 sediment pool it has been necessary to pump water from the site. During spring runoff season, it has been necessary to pump twice weekly. Four piezometers were installed at the site in May 2000. Although there is limited data at this point, it appears the groundwater at this site (commonly referred to as Tamaya Pond) is mostly influenced by the existing stream flow.

3.07 WATER QUALITY

In the spring of 1999, the Pueblo of Santa Ana, the New Mexico Fisheries Resource Office of the U.S. Fish and Wildlife Service, and the Corps cooperated in a preliminary study of heavy metal concentrations in the reservoir, sediments, and biota at Jemez Canyon Reservoir. Surficial sediment samples showed no contamination of metals, and one water sample was just above the detection limit (0.0002 mg/L) for mercury. (See additional discussion below regarding biota.)

3.08 AIR QUALITY AND NOISE

Sandoval County, which surrounds the trust lands of the The Pueblo of Santa Ana, is within the State of New Mexico's Air Quality Control Region 2 (EPA Region 152) (NMED 1997). The County is in attainment status for National Air Quality Standards for priority pollutants (particulate matter, sulfur oxides, nitrogen dioxide, carbon monoxide, ozone, and lead), meaning that ambient air quality meets or exceeds State and Federal standards. Generally, the only air pollutant of concern in the area is particulate matter (blowing dust during periods of high winds). In the State's Prevention of Significant Deterioration program administered by the New Mexico Environment Department, the region is designated Class II, which allows for moderate development and its associated air emissions. The nearest Mandatory Class I area to Jemez Canyon Reservoir is the Bandelier Wilderness Area, approximately 25 miles to the north.

Existing noise levels in the Jemez Canyon Reservoir area are very low, as is typical of rural locations. The major source of ambient noise is air traffic to and from local airports.

3.09 ECOLOGICAL SETTING

Plant Communities

The Rio Jemez delta is within the Plains-Mesa Sand Scrub biotic community as defined by Dick-Peddie (1993), and vegetation typical of this community dominates the entire area south of the Rio Jemez on Pueblo of Santa Ana lands. The following grasses and forbs occur in sparse to moderately dense stands throughout the area: black grama, New Mexico feathergrass, western wheatgrass, galleta, sand dropseed, and ring muhly. Shrubs commonly found throughout the area include fourwing saltbush, sand sagebrush, rabbitbrush, and bush penstemon. Unconsolidated sand dunes with sparse pioneer vegetation occur in a portion of this community. At slightly higher elevations, and often interspersed with the sand scrub community, are pinyon pine /one-seed juniper woodlands.

Prior to construction of Jemez Canyon Dam in the early 1950s, the Rio Jemez floodplain between the damsite and the old Pueblo of Santa Ana was very sparsely vegetated (USACE 1976). The river occupied a wide, braided channel through the area. Plant community establishment was likely hindered by ephemeral flows, periodic large floods, deposition of sediment, and a shifting channel. Riparian vegetation likely bordered at least a portion of the channel, especially near the western end of the current reservoir, but information on its location and extent is limited.

By the early 1970s, vegetation occupied about 624 acres of the 1,143-acre Jemez Reservoir flood pool below an elevation of 5,197 feet (USACE 1976). Vegetation development was likely enhanced by more frequent (but still periodic) flooding due to flood control operations, which generally increased soil moisture and nutrient availability. The widespread invasion of salt cedar throughout the middle Rio Grande Valley during this period also contributed to plant community development at Jemez Canyon Reservoir.

In 1976, the upper portion of the reservoir pool space near the proposed project impact area was vegetated by volunteer salt cedar with a modest understory of salt grass and sedges. A salty crust on the soil surface was common (USACE 1976). A dense and varied riparian community bordered the river channel, which wound through the reservoir (USACE 1976). Mixed stands of willow, cottonwood, Russian olive, and saltcedar were interspersed with western wheatgrass, mat muhly, ring muhly, and shadscale. The relatively moist soils along the river channel were able to sustain willow and cottonwood growth, while saltcedar dominated the drier soils throughout the remainder of the basin. Tree ages indicated that flood control storage during 1959 and 1965 was responsible for germination of most of the woody vegetation throughout the reservoir.

Vegetation patterns were not markedly different in 1984. The establishment of the 2,000-acre sediment pool in 1979 inundated up to 100 acres of dense saltcedar in the lower portion of the reservoir (USACE 1984). Plant communities in the upstream portion of the reservoir near the proposed project impact area appear to have been affected only locally where sediment deposition patterns were altered as a result of the pool. A narrow band of riparian vegetation occurs along the former sediment pool margins. In the delta area, large mixed stands of Rio Grande cottonwood, Gooding's willow, and coyote willow occur, intermixed with non-native Russian olive, salt cedar, and occasional Siberian elm.

Wetlands

A formal delineation survey of the Rio Jemez delta on the Pueblo of Santa Ana has been conducted by consultants to the Pueblo and inspected and confirmed by USACE Albuquerque District Regulatory Branch. The majority of the vegetated delta discussed above is classified as wetland as defined in Section 404(b)(1) of the Clean Water Act. The area is dominated by facultative and facultative-wetland species and is inundated by surface flows for at least 11 contiguous days during the growing season. The Rio Jemez channel and the current sediment pool are regulated "waters of the United States" as defined in Section 404 of the Clean Water Act.

Fish

No comprehensive fish surveys have been conducted in the vicinity of the proposed project area. Prior to the creation of the former sediment pool, the fish community was comprised primarily of native species such as gizzard shad, red shiner, longnose dace, fathead minnow, flathead chub, river carpsucker, smallmouth buffalo, western mosquitofish, and bluegill. These fish were adapted to the ephemeral condition of the lower Rio Jemez (USFWS 2001). No Rio Grande silvery minnows are currently known to occur upstream of the Jemez Canyon Dam, and therefore are not known to occur in the intermittent, sometimes ephemeral reach of the proposed project area.

As referenced in the water quality section, a preliminary study of heavy metal concentrations in the reservoir, sediments, and biota was conducted during 1999 at Jemez Canyon Reservoir. Tissue samples of largemouth bass and channel catfish indicated some bioaccumulation of mercury. Mercury concentrations in several samples were greater than 0.5 parts per million (ppm) wet weight, indicating a low level of risk for consumption. Preliminary comparison to the U.S. Environmental Protection Agency (1977) "reference doses" suggest that there could be a risk to young children and pregnant women consuming fish for as few as 14 days per year. However, due to the pool evacuation and on-going drought, the lower Rio Jemez remained dry from March 2002 until the occurrence of monsoon thunderstorms in July and August, and no live fish are known to be present in the proposed project area.

Wildlife

Riparian areas with moist soil conditions are considered important areas for many life stages of many species of Southwestern U.S. wildlife. The following species have been detected by surveys within the bosque area of the lower Jemez delta on the lands of the Pueblo of Santa Ana (Consultants to the Pueblo, Inc. 2001b; Walker 2001). It should be noted that a reservoir pool existed at the time that the above surveys were conducted. Please see Appendix A for a comprehensive list of birds, mammals, amphibians and reptiles that could potentially occur in Sandoval Co., NM near Jemez Canyon Dam and Reservoir Project.

Birds

Least Bittern	Gray Catbird	Mockingbird
Great Blue Heron	Townsend's Warbler	Common Yellowthroat
Black-Crowned Night Heron	Yellow-Breasted Chat	Song Sparrow
White-Faced Ibis	Yellow Warbler	Black-Headed Grosbeak
Kildeer	Peregrine Falcon	Western Scrubjay
Western Wood Pewee	Ruby-Crowned Kinglet	Evening Grosbeak
Dusky Flycatcher	Spotted Towhee	Vesper Sparrow
Gray Flycatcher	Western Meadowlark	Brown-Headed Cowbird
Cordillean Flycatcher	Bullock's Oriole	Lark Sparrow
Vermillion Flycatcher	Blue Grosbeak	Pine Siskin
Say's Phoebe	House Finch	American Crow
Ash-Throated Flycatcher	Raven	Black Phoebe
Western Kingbird	Northern Roughwinged Swallow	Yellow-Rumped Warbler
Violet-Green Swallow	Black-Chinned Hummingbird	Common Nighthawk
Cliff Swallow	Mourning Dove	Gambel's Quail
Barn Swallow	Northern Harrier	Red-Tailed Hawk
Bewicks Wren	Hairy Woodpecker	Northern Flicker

Yellow-Billed Sapsucker Mountain Chickadee Western Yellow-Billed Cuckoo
Southwestern Willow Flycatcher

Bats

Western Small Footed Myotis	Little Brown Myotis
Long-Legged Myotis	California Myotis
Pallid Bat	Pipistrelle
Mexican Free-Tailed Bat	Northern Long Eared Myotis
Western Mastiff Bat	Fringed Myotis
Big Brown Bat	Big Free-Tailed Bat
Hoary Bat	

Amphibians and Reptiles

Red Spotted Toad	Woodhouse's Toad
Western Chorus Frog	Bullfrog
Side-Blotched Lizard	Northern Mexican Whiptail
Plateau Striped Whitptail	Checkered Whiptail
Leopard Lizard	Striped Whipsnake
Slider	

Non-volant mammals that use the bosque area of the Rio Jemez delta on lands of The Pueblo of Santa Ana include furbearers, big and small game mammals, and a host of small rodents. Riparian habitat is used at least sporadically by virtually all of these mammals. The New Mexico Ecological Services Field Office of USFWS released a draft Fish and Wildlife Coordination Act Report regarding this proposed project in December 2001. From that report, appendix A lists potentially occurring mammals near Jemez Canyon Dam and Reservoir Project at The Pueblo of Santa Ana, NM.

Federally Threatened and Endangered Species

The Rio Grande silvery minnow (listed as Federally endangered July, 1994) is known to occupy the Rio Grande and may potentially occupy sections of the Rio Jemez downstream from Jemez Canyon Dam, but not above the dam. The silvery minnow likely had a historical presence in the lower Rio Jemez as demonstrated by collections made in 1958 (Hoagstrom 2000). However, as this sampling was conducted after the construction of the Jemez Canyon Dam, it is unknown if the silvery minnow ever occurred above the dam location. In the Proposed Rule (50 CRF Part 17, June, 2002) on Designation of Critical Habitat for the Rio Grande Silvery Minnow, the Rio Jemez is not designated as critical habitat for the species upstream of the Jemez Canyon Dam.

The Southwestern Willow Flycatcher (listed as Federally Endangered February, 1995) may occur in a variety of riparian habitat types along the Rio Jemez during spring or fall migration periods. Vegetation suitable for use during migration occurs at the margins of the Rio Jemez throughout the delta, and along the Rio Jemez downstream from the Dam. A survey to USFWS protocol standards was conducted throughout the Rio Jemez delta on the Pueblo of Santa Ana during the spring and summer of 2001, and no breeding Southwestern Willow Flycatcher pairs were documented (Walker 2001). A second survey was conducted in the spring and summer of 2002 by the Corps and the Pueblo of Santa Ana, and no breeding pairs were documented. A third survey of the proposed project impact area is being conducted from May 15 through July 17, 2003 to determine the presence or absence of breeding southwestern willow flycatchers. No willow flycatchers have been detected as of the date of this EA.

Breeding habitat for the Southwestern Willow Flycatcher includes very dense, tall (>=9ft.) shrubs or trees (willow, boxelder, Russian olive, saltcedar, and/or cottonwood) with a partial overstory, situated in or adjacent to saturated or moist soils or water bodies. Throughout the flycatcher's range, these riparian habitats are now rare, widely separated, and occur in small and/or linear patches. Low gradient streams and rivers are preferred habitat. Flycatchers begin arriving in the Rio Grande Valley of New Mexico as early as the first week of May, but more typically arrive in mid-to-late May. Potentially suitable flycatcher breeding habitat occurs in the delta at the western end of the Jemez Canyon Reservoir. The nearest known breeding flycatchers occur along the Rio Grande near San Juan Pueblo and Isleta Pueblo, 50 miles upstream and 35 miles downstream, respectively, from the confluence of the Rio Jemez.

Bald Eagles (downlisted to Federally Threatened 1995) are known to be present along the Rio Grande and have been present at Jemez Canyon Reservoir during the winter. Both adult and juvenile birds may be present in the area between late November and early March. The Corps conducted aerial surveys for Bald Eagles between 1988 and 1996 during January, the month of highest abundance. During the 8 years of survey, Bald Eagles were observed at Jemez Canyon Reservoir during 4 years and the number of birds observed ranged from 1 to 3. The same frequency and maximum number of eagles were observed along the main stem of the Rio Grande from the confluence of the Rio Jemez downstream to the Interstate 40 bridge at Albuquerque during the same survey period. The number of Bald Eagles observed along the Rio Grande from the Rio Jemez confluence north to and including Cochiti Lake was significantly higher. Collectively, these data indicate that Bald Eagles did not utilize the area around Jemez Canyon Reservoir preferentially when a pool existed. One Bald Eagle was sighted wintering in the vicinity of the evacuated pool of the reservoir during winter, 2001 (Wm. DeRagon, Biologist, Corps, pers. comm., 2002).

The Yellow-billed Cuckoo (Coccyzus americanus), western continental U.S. Distinct Population Segment (DPS) was assigned Candidate Status July 25, 2001 as warranted for listing under ESA but precluded because of higher priority species. While the cuckoo is still relatively common east of the crest of the Rocky Mountains, biologists estimate that more than 90 percent of the bird's riparian habitat in the West has been lost or degraded. These modifications, and the resulting decline in the distribution and abundance of Yellow-billed Cuckoos throughout the western States, is believed to be due to conversion to agriculture; grazing; habitat degradation by competition from nonnative plants, such as tamarisk; river management, including altered flow and sediment regime; and flood control practices, such as channelization and bank protection.

The western race of the yellow-billed cuckoo is associated with lowland deciduous woodlands, willow and alder thickets, second-growth woods, deserted farmlands, and orchards. Caterpillars form the main component of the diet, with cicadas, grasshoppers, beetles, bugs, ants, wasps, frogs, lizards, and small fruit being consumed in smaller amounts. Populations fluctuate substantially in response to fluctuations in caterpillar abundance. Declines resulting from loss or disturbance of riparian habitat have been consistently reported in the West. The greatest factors affecting the yellow-billed cuckoo have been the invasion of exotic woody plants into Southwestern riparian systems, and clearing of riparian woodlands for agriculture, fuel, development, and attempts at water conservation

Walker (2001) estimated at least 10 pairs of Western Yellow-billed Cuckoos inhabited the Jemez Canyon delta on the Pueblo of Santa Ana based on a 2001 survey of the area. A pair of yellow-billed cuckoos was observed off the proposed project impact area in June, 2002 and individuals were heard in June, 2003 (Matt Clark, Pueblo of Santa Ana and Champe Green, USACE, pers. comm., 2003)

State of New Mexico Endangered and Threatened Species

New Mexico has separate provisions from federal law for endangered plants and animals. The New Mexico Department of Game and Fish, through its Conservation Services Division, administers the Wildlife Conservation Act. (NMSA 1978 § 17-2-37 et seq.) The Act requires the listing of any species or subspecies of "wildlife indigenous to the state" as endangered or threatened on the basis of investigations and other scientific and commercial data, and after consultation with wildlife agencies in other states, federal agencies, local and tribal governments, and other interested persons and organizations. It is important to note that federally recognized tribal reservations are sovereign and exempt from compliance with state wildlife laws.

The Peregrine Falcon is listed as Threatened in New Mexico, and individuals were observed in the bosque area of the Rio Jemez delta on Pueblo of Santa Ana land in the fall of 2001 (Consultants to the Pueblo, 2001)

A state threatened species that may occur but is not documented as occurring on the proposed project impact site is the New Mexico meadow jumping mouse. The New Mexico meadow jumping mouse is found in riparian meadows of grass and forbs. In both the Jemez Mountains and the Rio Grande Valley, Morrison (1992) found that preferred habitat for the meadow jumping mouse contained permanent streams, moderate to high soil moisture, and dense and diverse streamside vegetation consisting of grasses, sedges, and forbs. Since the lower Rio Jemez without the sediment pool in the Jemez Canyon Reservoir is intermittent at best (and likely ephemeral when agricultural diversion occurs upstream of the proposed project area), it is unlikely that the meadow jumping mouse occurs within the project area.

The project area might include several Species of Concern, of which those most likely to be present are the big free-tailed bat, long-eared myotis, and Townsend's big-eared bat. Big free-tailed bats prefer coniferous and mixed woodland and depend on rocky cliffs for roosting. However, they have been found in sycamore and cottonwood riparian habitats (BISON-M 2001). The long-eared myotis occurs in coniferous forests at moderate elevations. It is most common in ponderosa pine woodlands and is also found in pinon-juniper woodlands and subalpine forests. The animals use day roosts in tree cavities, under loose bark, and in buildings. These sites as well as caves and mines are used for night roosts. The long-eared myotis feeds over water and along the margins of vegetation, and thus may use the project area when the reach is wet (BISON-M 2001). Townsend's big-eared bat occurs widely in the state during summer and can be found over desertscrub, in shelters in desert-mountains, oak-woodland, pinyon-juniper, or coniferous forests. This bat occupies a diversity of habitats, including desert shrublands, pinyon-juniper woodlands, and high-elevation coniferous forests. However, it does forage over water and thus could potentially occur at the proposed project site when the river reach is wet (BISON-M 2001).

The Forestry Division of the Energy, Minerals and Natural Resources Department (EMNRD) administers the Endangered Plant Species Act, passed in 1985 (NMSA 1978 § 75-6-1). This Act acknowledges only one status, "Endangered." The only rare plant potentially occupying the proposed project impact area is Parish's alkali grass, a state endangered grass and categorized as a Species of Concern by USFWS. It requires wet alkaline soils. It occurs at the heads of drainages or on gentle slopes at 800-2,200 m (2,600-7,200 ft) range-wide. The species requires continuously damp soils during its late winter to spring growing period. It frequently grows with salt grass, alkali sacaton, sedges, bulrushes, rushes, spike rushes, and yerba mansa (NMRPTC 1999).

3.10 LAND USE, RECREATION, AND AESTHETICS

All lands associated with the Jemez Canyon Dam and Reservoir Project are held in trust by the United States for the benefit and use of the people of the Pueblo of Santa Ana. The Department of the Army and the Pueblo of Santa Ana signed an MOU in 1952 (augmented in 1978 by P.L. 95-498) which established a perpetual right and privilege for the construction, operation, and maintenance of the Jemez Canyon Dam and Reservoir Project. The Pueblo of Santa Ana reserved the right to use all associated lands for any purposes not inconsistent with those expressly granted to the government for the facility.

No livestock are now allowed to graze in the project area; however an occasional breach of fencing may occur with resultant short-term utilization of the area by cattle. Hunting, hiking, fishing, swimming, horseback riding, and ceremonial activities occur near the proposed project impact area.

3.11 CULTURAL RESOURCES

Cultural resources surveys of the project location including the weir construction area, access road, and staging areas, have been completed in consultation and cooperation with the Pueblo of Santa Ana and coordinated through the Pueblo of Santa Ana's Department of Natural Resources. The Corps is the lead review agency and reviewed the cultural resources inventory survey reports and the scope-of-work for limited testing. The Pueblo of Santa Ana contracted with Earth Analytic, Inc. to perform the cultural resources surveys and limited testing.

Prior to the surveys, Earth Analytic and the Corps conducted searches of the New Mexico Historic Preservation Division, Archeological Records Management Section's database that found that numerous archaeological sites occur on Pueblo of Santa Ana lands and several newly recorded sites are located near the project areas (Penner, Duncan, Byszewski, and Dorshow 2003 [EA 66.01]; Penner, Baletti, Byszewski, and Dorshow 2001 [EA 41a]). Searches of the State Register of Cultural Properties and National Register of Historic Places found that there are no known historic properties reported to occur within or immediately adjacent to the project areas other than LA8975, the Pueblo of Tamaya.

During project planning, tribal members indicated that no Traditional Cultural Properties would be affected by the projects described below. During construction, work operations may be temporarily suspended for Pueblo ceremonies or special functions. Temporary work suspensions would be coordinated through all appropriate points-of-contact.

In late January and early February 2002, Earth Analytic, Inc. conducted a cultural resources inventory of two survey areas, covering a total of about 13.6 hectares (33.7 acres). The first area, identified as the Delta Neck Area and located at the upstream end of the sediment pool of the evacuated Jemez Reservoir, included the surveying of four alternative weir alignments and the adjacent gravel terraces located along the north bank of the reservoir. This survey covered approximately 12.5 hectares (31.0 acres; Dorshow and Barz 2002 [EA 41b]). The survey resulted in the discovery of one archaeological site, identified as LA135152. Earth Analytic recommended that the site is eligible for inclusion to both the State and National Registers. The Corps agrees that the LA135152 site is eligible.

The second survey area was identified as the Southeast Access Road; the survey covered about 1.1 hectares (2.7 acres). The Southeast Access Road is located near and upstream of Jemez Canyon Dam's emergency spillway. No artifacts, cultural resource manifestations, or archaeological sites were observed during the Southeast Access Road survey.

Prior to the surveys of the Delta Neck Area and the Southeast Access Road, Earth Analytic conducted searches of the New Mexico Historic Preservation Division, Archeological Records Management Section's database and of the State Register of Cultural Properties and National Register of

Historic Places. The searches found that while numerous archaeological sites occur on Pueblo of Santa Ana lands, there are no archaeological sites or historic properties located in the immediate vicinity of the surveyed areas.

Since the survey of the Delta Neck Area was conducted, the recommended alignment for the proposed weir has been moved a significant distance downstream of LA135152, and none of the four surveyed Delta Neck Area weir alignments are to be used; therefore there is no project in this area and there would be no effect to LA135152. Since there are no cultural resources known to occur near the Southeast Access Road, use of the road would have "No Effect to Historic Properties."

Between July 7 and October 2, 2002, Earth Analytic, Inc. conducted the cultural resources inventory survey of the weir construction site, the access road, and two staging areas located between U.S. Highway 550 and the upstream end of the Jemez Canyon Reservoir's sediment pool. The weir alignment, access road and staging areas survey covered a total of 28.5 hectares (70.46 acres; Penner, Duncan, Byszewski, and Dorshow 2003 [EA 66.01]). The proposed project provides for improvements to the access road that include gravel surfacing, straightening of sharp corners, and surface water drainage features. During the cultural resources survey, four archaeological sites were discovered within the alignment of the existing road (LA137047, LA137048, LA137049, and LA137050) and one archaeological site (LA137046) was discovered near the southern end of the newly proposed weir alignment.

The existing road crosses the four archaeological sites and limited testing was conducted at all four sites to determine their nature and extent. In consultation with the Pueblo of Santa Ana, it was determined that, rather than realigning the road (to bypass the four sites) and risk the possibility of discovering other cultural resources, the most practical solution would be to utilize the existing access road that has been in use for many years, and cover the four sites with 18 to 24 inches of clear earthen fill material to protect the sites in addition to the materials to be used to construct the road's surface. At the request of the Pueblo of Santa Ana, artifacts discovered within the road construction area were collected, analyzed, and were reburied at a known location within the confines on the site but outside of the road right-of-way. Artifacts and cultural manifestations observed at the four sites are similar and include chipped-stone, ceramics, ground-stone, and charcoal stain features.

Subsequent to the discovery of the LA137046 site near the southern end of the proposed weir, Corps' engineers redesigned the proposed weir resulting in a slight realignment; moving the southern one-half of the proposed weir further downstream, away from LA137046. Therefore, the construction of the Weir and Access Road project would have "No Adverse Effect" to the LA137047, LA137048, LA137049, and LA137050 sites located along the road and there would be "No Effect" to the LA137046 site near the southern end of the weir. Monitoring will occur during all earth-moving construction activities. The existing access road, to be used to access the weir construction site, crosses the old, historic 1940s Santa Fe Northwest Railroad grade (EA41.04, LA138836 [LA78691]), at about a right angle. The Corps is of the opinion that use of the rehabilitated road would have "No Adverse Effect" on the old railroad grade.

Earth Analytic recommended that sites LA137046, LA137047, LA137049, and LA137050 are eligible for inclusion to both the State and National Registers and that LA137048 was potentially eligible. The Corps agrees with Earth Analytic's eligibility recommendations for these sites.

During engineering design work on the Jemez Weir Access Road, it was determined that, in several locations, eroding arroyos may threaten the road in the near future and therefore erosion control measures should be planned for. When the proposed locations for erosion control features were

determined, Earth Analytic conducted a cultural resources survey of three areas, as well as an area where the road alignment was to be slightly realigned. The survey was conducted on April 16, 2003, covering a total of 20.7 hectares (51 acres), and is reported by Byszewski 2003. During the survey, one archaeological site was discovered; LA139126 is a lithic and ceramic artifact scatter with two thermal stain features.

The site has been significantly affected by surface water erosion with Earth Analytic estimating that only 30 percent of the site remains intact. The proposed erosion control structure for the primary arroyo in this area would be located about ten meters outside of the site boundary as defined by Earth Analytic. Pueblo of Santa Ana Tribal representatives originally had concerns and therefore visited the site; however, they determined that access to and from the location and the proposed installation of the erosion control structure, sheet piling to be driven into place with wire-wrapped, rock filled gabion baskets placed immediately downstream of the sheet piling, would not affect the archaeological site.

Earth Analytic recommended that the site was potentially eligible for nomination to the State and National Registers. The Corps agrees that the site is potentially eligible and the Corps is of the opinion that the proposed project would have "No Effect" on the LA139126 site.

Culture history for the Pueblo of Santa Ana and generally for the middle Rio Grande area has been documented in numerous references such as White (1942), Cordell (1979, 1984, 1997), Ortiz (1979), Strong (1979), and Bayer (1994). The Northern Rio Grande Region has been archaeologically defined by Wendorf and Reed (1955). Archaeological surveys conducted in the Santa Ana Pueblo area have been reported by Enloe (1976), Rodgers (1979), Hammack (1981), Harrill (1984), Walt and Marshall (1986a, 1986b), Frizell and Acklen (1987), Condie (1993), Anschuetz *et al*. (1995), Bradley and Brown (1998), and Brown (1999). In recent years, the Pueblo of Santa Ana has been actively working to develop and protect its natural and cultural resources and has sponsored numerous archaeological surveys on Pueblo lands in anticipation of construction and rehabilitation projects and habitat restoration efforts related to Pueblo conservation and development. Some of these recent Pueblo of Santa Ana projects include Acklen *et al*. (1998), Acklen and Railey (1998), Larralde (1999, 2000), Penner *et al*. (2001a), and Everhart (2001, 2002).

The Corps is of the opinion that there would be "No Adverse Effect to Historic Properties" by the proposed project or on the historic and cultural resources of the region. Should previously unknown artifacts or cultural resource manifestations be discovered during construction, work would be stopped in the immediate vicinity of the find, a determination of significance made, and a mitigation plan formulated in consultation with the Pueblo of Santa Ana and the New Mexico State Historic Preservation Officer. All archaeological site recording forms and reports have been submitted to the Pueblo of Santa Ana and the New Mexico State Historic Preservation Officer. Consultation with the Pueblo of Santa Ana and the New Mexico State Historic Preservation Officer is documented in Appendix B.

3.12 SOCIO-ECONOMIC ENVIRONMENT

The Pueblo of Santa Ana Reservation covers approximately 79,000 acres spanning the Rio Grande and lower Rio Jemez. The majority of the population of approximately 850 resides in three communities along the east side of the Rio Grande. The historic pueblo mentioned previously in this document is located along the Rio Jemez.

Principal employment sectors include agriculture, government, and service. Over the past 25 years, the Pueblo of Santa Ana has developed a successful agricultural enterprise centered on the production and processing of organic blue corn products. Other natural resource enterprises include sand

and gravel mining and a native plant nursery. Extensive recreational and entertainment attractions include the Santa Ana Star Casino, the Prairie Star Restaurant, two golf courses, a 22-field soccer complex, and the Tamaya Hyatt resort which opened in December 2000.

4. PLAN FORMULATION

Beginning in 2001 and ongoing, the Pueblo of Santa Ana facilitated monthly planning sessions with the Corps, consultants to the Pueblo, and the USFWS to discuss objectives for the mitigation of the evacuation of the Jemez Canyon Reservoir sediment pool. Through these sessions and ensuing coordination and data collection, a set of alternatives was developed. The Corps' HEC-6 modeling software was used to estimate river channel changes that would occur from pool evacuation. As a result of the model runs, four low-head sheetpile weir location alternatives were considered to remedy the predicted channel incision that would jeopardize the mixed native/exotic species bosque above Rangeline four. After analyzing the alternatives with the Corps' incremental analysis software, the following incremental costs per unit (acre) of habitat conserved were considered.

Option	Cost	Ac. Protected	Avg. $/Ac.	Incremental $	Incremental Ac. Protected	Incremental $/Ac.
No Action	$0.00	0	$0.00	$0.00	0	$0.00
Weir Location Option 1	$1,931,700.00	299	$6,460.54	$1,931,700.00	299	$6,460.54
Weir Location Option 2	$2,083,300.00	323	$6,449.85	$151,600.00	24	$6,316.67
Weir Location Option 3	$2,729,100.00	355	$7,687.61	$645,800.00	32	$20,181.25
Weir Location Option 4	$3,451,500.00	390	$8,850.00	$722,400.00	35	$20,640.00

Location option one was dismissed due to the potential visibility of the weir from the old Pueblo upstream. Location option two was dismissed because of its low number of bosque acres protected/conserved. Location option three was dismissed because its location would disturb a cultural site important to the people of the Pueblo of Santa Ana. The site is also eligible for the Registry of National Historic Preservation Cultural Sites. Location option four was the selected alternative because of the following reasons: 1) largest acreage of bosque conserved; 2) not visible from the old Pueblo, and 3) absence of cultural resources within the construction impact area.

5. FORESEEABLE EFFECTS OF THE PROPOSED PLAN AND NO-ACTION ALTERNATIVE

5.01 EFFECTS OF THE PROPOSED PLAN

Sedimentation

The primary purpose of the proposed sheetpile weir is to prevent vertical channel incision (erosion) above Rangeline R-4. The insertion of a sheetpile weir within the channel would halt the knickpoint of channel incision which could eventually cause the undesirable outcomes of mass slumping of streambanks, deepening of the channel, and loss of opportunity of further development of depositional bars, braids, and floodplain material and accruing native vegetation.

Geomorphology and Hydrology

Potential degradation of the Rio Jemez channel would be minimized by insertion of a sheetpile grade control structure installed at the downstream end of a mixed species bosque. This action would arrest headcutting which has originated downstream as a consequence of the increased gradient since the 2001 pool evacuation.

Very low flows would overtop the proposed low-head weir at the notch. At the higher (4 ft. above channel invert) elevations of the weir, the weir would be overtopped at between 1,000 and 3,000 cfs. The purpose of the taper of the weir from 2 to 4 ft. above channel invert, coupled with its planform shape, is to maintain lower flows in a central, though still relatively wide, portion of the channel, and to minimize bank erosion at higher discharges. At higher flows, sediment would precipitate out of bedflow along the flanks of the weir. Additionally, channel incision and mass slumping of banks would be minimized with the insertion of the low-head weir.

Geology and Groundwater Hydrology

There are no aspects of the proposed plan that would affect the geological characteristics of the area. No impact is anticipated upon fault zones in the vicinity of the project site. There has been no seismic activity centered near the dam or reservoir since completion of the dam construction in 1953.

In the event that the Pueblo of Santa Ana, the Corps, and other collaborating agencies decide to store water in the pool area of Jemez Canyon Reservoir in the future, for whatever reason, the sheetpile weir will not effect surface or groundwater hydrology (Darrel Eidson, Hydraulic Engineer, Corps, pers. comm. 2002).

Water Quality

An individual Section 404 wetlands dredge and fill discharge permit has been obtained from the Regulatory Branch of the Albuquerque District. A section 401 Water Quality Certification Permit has been obtained from Region 6 of the U.S. Environmental Protection Agency. A section 402 Storm Water Pollution Prevention Plan will be prepared by the Government or the construction contractor and a Notice of Intent will be filed with USEPA Region 6. The plan will include the best management practices to be employed to minimize erosion and stormwater runoff from areas disturbed during construction.

No adverse effects to water quality are anticipated within the channel as a result of the long-term presence of the low-head weir. Indeed, as the proposed project reach is a Rosgen D5 channel type characterized by bank instability, high sediment loads and turbidity, the proposed weir should enhance water quality downstream by facilitating streambank stability upstream and causing sediment to precipitate out of flow behind the 4-ft. high sections of the weir at flows from 1,000 to 3,000 cfs.

Air Quality

The approximately 22 acres (18 acres of riparian vegetation, 1.5 acres of channel bed, and 2 acres of staging area) of the construction disturbance exposed after the placement of the low-head weir would be highly susceptible to wind erosion. This area would be revegetated as quickly as planting season and soil moisture constraints allow.

Vegetation

Approximately 18 acres of riparian vegetation would be disturbed by construction activities along the proposed weir location. An additional two acres of upland staging area would be disturbed. The

riparian vegetation destroyed would be site prepared and replanted with Rio Grande cottonwood and coyote willow poles during the first dormant season opportunity following construction. Site preparation and seeding of xeric and/or mesic grasses and forbs on the upland staging area would be planned for the following spring and summer after construction is completed.

The fairly extensive wetland and riparian vegetation growing upon the river delta upstream of the proposed weir would be positively affected by the proposed plan. An estimated 390 acres of established mixed native and extotic riparian bosque and wetland would be protected from groundwater decline.

No federally listed plants are believed to occur in the project area. While there is potential for the state endangered Parish's alkali grass (also USFWS Species of Concern) to occur within the project impact site, it is not documented to occur there. State listings are not relevant on sovereign tribal lands, though the Pueblo of Santa Ana strives to conserve and protect rare species.

Fish

There are presently no fish species known to be present in the lower Rio Jemez above the Dam and within the project impact area. When substantial flows return to the lower Rio Jemez, some emigration of fish from upstream may occur. No adverse effect is anticipated from this proposed project upon fish. The insertion of the proposed sheetpile weir may contribute to future habitat (off channel pools, river margins, slackwater refugia) of fishes adaptable to warm water and intermittent or ephemeral flow conditions, should the Pueblo of Santa Ana desire to release native and/or adapted game fish within this subject reach in the future. This improved habitat would result from the weir effect of minimizing or preventing incision and encouraging overbank flooding.

Wildlife

The anticipated effects of the proposed action upon most faunal species are considered to be positive. Groundwater declines above range line R-4 are expected to be minimized due to the construction of the low-head weir and prevention of channel incision. The proposed alternative would minimize channel degradation through 390 acres of mixed native and exotic species delta (Consultants to the Pueblo Inc., 2001). Moist-soil conditions behind the weir would be beneficial to insects and bird, bat, and mammal insectivores. An increased availability of soft mast crops (i.e., berries from wolfberry, New Mexico olive, skunkbush sumac) for herbivorous animals would result from moist-soil conditions created upstream of the weir.

Threatened and Endangered Species

Southwestern Willow Flycatcher

The proposed alternative would minimize channel degradation through 390 acres of mixed native and exotic species delta, which includes approximately 223 acres of potential breeding habitat for the Southwestern Willow Flycatcher. Approximately 3.6 acres of potential willow flycatcher habitat would be disturbed by construction activities, all of which would be revegetated with willows and cottonwoods at the earliest planting opportunity following construction.

All construction activities will occur outside of the willow flycatcher breeding, nesting, and brooding season if resident southwestern willow flycatchers are detected during a protocol survey.

No breeding willow flycatchers have been documented in the proposed project impact area either

in 2001, 2002, or 2003, as a result of successive surveys conducted to USFWS protocol.

Bald Eagle

No mature trees that could be used for winter roosting would be disturbed during the proposed construction. The presence/absence of Bald Eagles during fall and winter construction activities would be monitoried. To minimze direct disturbance to Bald Eagles, the following precautions would be observed during project construction if a Bald Eagle(s) is observed.

If a Bald Eagle is present within 0.25 mile (0.4 km) of the construction activity in the morning before project activity begins, or arrives during breaks in project activity, the contractor would be required to suspend all activity until the bird leaves of its own volition; or a Corps biologist, in consultation with the Service, determines that the potential for harassment is minimal. However, if a Bald Eagle arrives during construction activities or if an Eagle is greater than 0.25 mile away, construction need not be interrupted.

If Bald Eagles are consistently found in the immediate project area during the construction period, the Corps would contact the Service to determine whether formal consultation under the ESA is necessary.

Rio Grande Silvery Minnow

Since the Rio Grande Silvery Minnow has not been documented to occur in the Rio Jemez upstream of the Jemez Canyon Dam, no effect by the proposed action is foreseen upon this species.

Endangered Species Act Compliance Summary

In summary, the proposed plan may effect but is not likely to adversely affect the Bald Eagle or the Southwestern Willow Flycatcher, and it would have no effect on the Rio Grande Silvery Minnow or its designated critical habitat.

Recreation and aesthetics

Stabilization of the Rio Jemez channel and associated delta within the land of the Pueblo of Santa Ana will likely provide for improved habitat for game and non-game species over the long term, thus providing stable or increasing opportunities for hunting, hiking, seasonal fishing, ceremonial activity, and wildlife viewing.

Cultural Resources

During project planning, tribal members indicated that no Traditional Cultural Properties would be affected by the weir construction project. During construction, work operations may be temporarily suspended for Pueblo ceremonies or special functions. Temporary work suspensions would be coordinated through all appropriate points-of-contact.

The Corps is of the opinion that there would be “No Adverse Effect to Historic Properties” by the proposed project or on the historic and cultural resources of the region. Should previously unknown artifacts or cultural resource manifestations be discovered during construction, work would be stopped in the immediate vicinity of the find, a determination of significance made, and a mitigation plan formulated in consultation with the Pueblo of Santa Ana and the New Mexico State Historic Preservation Officer.

Consultation with the Pueblo of Santa Ana and the New Mexico State Historic Preservation Officer is documented in Appendix G.

Socio-economic Considerations

The proposed construction of the low-head weir on the Rio Jemez would not significantly affect economic enterprise at the Pueblo of Santa Ana Reservation or in Sandoval County.

5.02 FORESEEABLE EFFECTS OF THE NO ACTION ALTERNATIVE

Sedimentation

Under the no-action alternative, a predicted incision of up to 7 ft. would occur through the former sediment pool area to R-4. Further incision of 2-3 ft. upstream of R-4 would likely cause streambank instability evidenced by mass slumping of relatively unstable soils and senescence of native streambank vegetation. However, the abovementioned streambank instability would likely result in the further development of depositional point bars and braids within the channel bed (Consultants to the Pueblo, 2001).

Geomorphology and Hydrology

Subsequent to the evacuation of the reservoir in October, 2001, a definitive incised channel developed in the deposition delta near the dam. This channel was unstable because of lack of vegetal stabilization, and headcutting initiated. Based on hydrologic modeling results, it is estimated that the river bed could incise as much as 14 feet from its present elevation. A deep, narrow initial channel shape in the deposition area behind the dam has begun, though the channel could become wider and less deep as this unvegetated river segment seeks an equilibrium between sediment load and velocity. However, the probability of significant entrenchment of the Rio Jemez channel in the upper reservoir where stabilizing vegetation is present would become increasing likely through the ensuing months if the proposed alternative is not implemented.

Geology and Groundwater Hydrology

The no-action alternative would not affect the geological characteristics of the area, fault zones in the vicinity of the reservoir, or substrate stability at the dam and outlets works. Groundwater occurrence at the old Pueblo would be somewhat diminished due to predicted channel incision, but not eliminated. Groundwater levels throughout the mixed native and exotic bosque would be predicted to decline from 4-7 ft. at Rangeline 4 and 2-3 feet upstream as a result of ongoing channel bed degradation.

Water Quality

A combination of unstable eroding streambanks and/or vertical incision of the channel will continue to contribute sediment to downstream locations. However, as a Rosgen D5 channel is inherently unstable with high sediment loads, no significant change in wash load or bed load and turbidity in localized areas is expected.

Air Quality

No measurable effect upon air quality is foreseen with the no-action alternative. However, a dying bosque lost to groundwater decline will likely lessen uptake of carbon dioxide and production of

oxygen. This is in contrast to the respiration benefits exuded by a vigorously growing bosque.

Vegetation

Riparian obligate and wetland vegetation in the Rio Jemez delta will likely decline in vigor under the no-action alternative and competition of native shrubs and trees with non-natives for declining surface and groundwater may result in mortality of native plants. This scenario will likely result in more intense colonization of exotic and undesirable vegetation, e.g., saltcedar and Russian olive.

Fish

No effect upon fish by the no-action alternative is foreseen.

Threatened and Endangered Species

The no-action alternative is likely to adversely affect the potential for use of the impacted area by breeding and nesting Southwestern Willow Flycatchers by the result of declining soil moisture as a result of channel incision. Declining soil moisture can be directly correlated with delayed or aborted flowering of riparian plants, increased stress upon and mortality of riparian vegetation, and ultimately, less insect abundance for the insectivorous willow flycatcher. The no-action alternative could affect the vigor and tenure of cottonwood sapling and pole trees used for future Bald Eagle winter roosting. The no-action alternative is not anticipated to have any effect upon Rio Grande silvery minnows, as none are currently present; but no-action could limit any future options for translocation of minnows into this reach of the Rio Jemez (should the Pueblo of Santa Ana so desire). This option could be negated due to channel degradation, i.e., narrowing and deepening, under the no-action alternative.

Land Use, Wildlife, Recreation, and Aesthetics,

The no-action alternative would likely have adverse effects upon plant vigor and survivability, thus having negative consequences for wildlife reliant on riparian and wetland vegetation for food, cover, water, and other necessary niche components. Game and non-game animals could emigrate from the delta area, thus affecting hunting, wildlife viewing, and other recreation opportunities. Ceremonial activities could be negatively impacted by a dying bosque on the delta. Aesthetics would likely decline in value as native vegetation is replaced by exotic communities or desertification ensues.

Socio-economic Considerations

Potential effects of the no-action alternative would be similar to those for the proposed plan.

Cultural Resources

The Corps is of the opinion that the no-action alternative would have no effect upon cultural resources on the Pueblo of Santa Ana.

5.03 CUMULATIVE EFFECTS AND FORESEEABLE FUTURE ACTIONS

"Cumulative effect" under the National Environmental Policy Act refers to the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. As discussed previously, the action evaluated in this EA is expected to

continue into fiscal year 2003.

A summary of the Pueblo of Santa Ana's and Corps' preliminary determination of future, post-pool conditions is presented below.

Dam and outlet works. -- Prior to the establishment of the existing sediment pool, complete closure of the flood control gates was problematic due to sedimentation problems at the intake. This problem was alleviated when a larger sediment pool was established in 1986, but will again become a flood control operation concern after cessation of the pool. A 1984 feasibility study analyzed structural solutions to the problem and recommended a multi-level intake structure (Leedshill-Herkenhoff, Inc. 1984). These and other viable alternatives are anticipated to be the focus of a FY03 design study to evaluate structural solutions in context of the changed geomorphological conditions of the Rio Jemez and the Rio Grande below their convergence.

Groundwater. -- Bank storage due to the years of impoundment will continue to be released over several years following the termination of the pool in October 2001. Piezometers will continue to be monitored and additional piezometers have been installed throughout the reservoir area.

Land use

The Pueblo of Santa Ana is formulating a land use plan for the reservoir area following the elimination of the sediment pool. In the interest of stewardship and to fulfill their trust responsibilities, the Corps is assisting the Pueblo in the formulation and implementation of their land use plans.

6. SUMMARY AND CONCLUSION

The Jemez Canyon Dam and Reservoir Project was authorized by the Flood Control Acts of 1948 (P.L. 80-858) and 1950 (P.L. 81-516) for flood damage reduction and sediment retention. Construction of the dam began May 1950 and the facility was completed and placed into operation in October 1953. All lands associated with Project (approx. 6,711 ac.) are held in trust by the United States for the benefit and use of the Pueblo of Santa Ana.

The reservoir did not include a permanent pool for the first 26 years of operation. In 1979, the Corps and the New Mexico Interstate Stream Commission (NMISC) agreed to establish a 2,000-acre-foot sediment retention pool. To further improve sediment retention, the Corps and NMISC agreed, in a 1986 Memorandum of Understanding (MOU), to store water within the remaining sediment storage space, as much as 29,712 acre-feet at that time. The Corps-NMISC storage agreement expired on December 31, 2000 (the MOU's original expiration date). The existing sediment pool was evacuated by October, 2001 and has not been refilled.

The proposed action evaluated in this EA entails the following: The Corps and the Pueblo of Santa Ana propose a series of four interlocked polyvinyl chloride (PVC) sheetpile sections. The weir would be oriented roughly perpendicular to the Rio Jemez channel, approximately 2.5 miles upstream of Jemez Canyon Dam. The suggested weir design has a series of 4 vertical drops where the river thalweg will drop a total vertical distance of 14 ft. A 25-ft. long downstream horizontal impact zone of wire-enclosed rock would be placed below the sheetpile weir sections in the invert. The lateral extent of the first vertical drop would be across the entire width of nonvegetated channel, with successive drops increasing uniformly in extents at 45 degrees. Only the second row of sheet piling would be extended to high ground on each side of the river. The top of the second row would increase in incremental one-foot high steps. Stair-stepped configuration of the second row of sheet piling is meant to induce over bank

flows towards the center of the weir structure. Two additional sheet-piling rows would extend diagonally from second row to the third and fourth row along created slopes. These diagonal rows of sheet piling are intended to add stability to wire enclosed rock protection set on slope and to divert flow back towards the center of weir structures.

Two wing dikes would be constructed, one on each side of the river channel on the upstream side of the weir to maintain higher peak flows within the existing channel. The wing dikes would be earthen berms, covered in rock armor, with a maximum height of about two ft. above the height of the weir. The dikes would be approximately 450 ft. long, flaring out from each bank in the upstream direction. The Corps has conducted a hydraulic analysis study to justify this design.

The rock for the wire-enclosed aprons and wing dike armor would be removed from an existing basalt quarry located on Pueblo of Santa Ana land in the vicinity of the dam site. Rock would be extracted with explosive charges, then crushed and stockpiled at the quarry site.

A staging area, not to exceed two acres, would be provided for the contractor's use during the construction phase of the project. Construction limits of 50 ft. upstream of the weir and 200 ft. downstream of the weir would be established around the perimeter of the project to prohibit any unnecessary destruction of habitat. The project site would be accessed via an existing four-mile-long two-track road originating from U.S. Hwy 550 (Figure 2). This access road would be improved with accepted rural road best management practices to accommodate heavy vehicular traffic while minimizing soil erosion and maintaining water quality standards and protecting other natural/cultural resources.

Final design of the weir would be accomplished by August, 2003, and construction would be performed during August, 2003 through March, 2004. The staging area (two acres) and construction corridor (18 acres) and any other upland areas disturbed by construction activities would be revegetated with native plant species after construction is completed, as soon as temperature and moisture conditions allow. Howevr, species selection and planting density will be tempered by the potential for fuel accumulation near the weir which, if ignited, could destroy or damage the weir.

The proposed plan is compared to the method, timing, and potential effects of the no-action alternative. Because there are no proposals for future permanent water storage in Jemez Reservoir, that action was not considered a reasonable alternative for evaluation in this Environmental Assessment.

Prior to implementation of construction activity under the proposed plan, an individual permit relative to Section 404 of the Clean Water Act would be obtained from the Albuquerque District Regulatory Branch, and a Section 401 Water Quality Certification Permit would be obtained from the U.S. Environmental Protection Agency, Region 6.

In consideration of the relative effects to the human environment evaluated in this Environmental Assessment, the proposed plan is recommended for implementation.

7. PREPARATION, COORDINATION, AND REVIEW

7.01 PREPARATION AND COORDINATION

This Environmental Assessment document was prepared by the U.S. Army Corps of Engineers, Albuquerque District. Principal preparers included:

Alan CDeBaca	Cost Estimator.

Darrell Eidson, P.E.	Hydraulic Engineer, B.S. Civil Engineering.
Greg Everhart	Archeologist, B.S. Archeology
Donald Gallegos	Hydraulic Engineer, B.S. Civil Engineering
Champe Green, CWB	Ecologist, M.S. Wildlife Science.
Brian Jordan	Chemist, B.S. Chemistry.
Russ Jaramillo	Civil Engineer, B.S. Civil Engineering.
Ron Kneebone, Ph.D.	Project Manager, Ph.D., Archaeology.

Supervisory review and oversight were provided by:

William DeRagon	Biologist, Environmental Resources Branch; M.S. Wildlife and Wetland Ecology

The cooperation of the following representatives of the Pueblo of Santa Ana was crucial in the preparation of this document:

Myron Armijo	Governor
Glenn Tenorio	Lt. Governor
Glenn Harper	Rangeland and Wildlife Division Manager
Les Ramirez	Consultant to the Pueblo
Jennifer Wellman	Water Resources Division Manager
Alan Hatch	GIS/IT Division Manager

7.02 REVIEW OF THE DRAFT ENVIRONMENTAL ASSESSMENT

Availability of the draft EA was advertised in the Albuquerque Journal and the Rio Rancho Observer. The public review comment period opened on June 19, 2003 and closed on July 23, 2003. No public comments were received on the draft EA. The notice of availability of the final EA and FONSI were also advertised in the above newspapers.
Paper copies of the draft EA were made available for review at:

- Albuquerque Public Library, Main Branch, 501 Copper Ave. NW, Albuquerque;
- Bernalillo Roosevelt Public Library, 134 Calle Malinche, Bernalillo;
- Esther Bone Memorial Library, 950 Pinetree Road, Rio Rancho;
- Pueblo of Santa Ana, Dept. of Natural Resources, 221 Ranchitos Rd., Santa Ana Pueblo; and
- U.S. Army Corps of Engineers, 4101 Jefferson Plaza NE, Albuquerque.

The draft NEPA document was made available in digital format at the U.S. Army Corps of Engineers Albuquerque District's web page: http://www.spa.usace.army.mil . The following federal, state, tribal, and private entities, and their respective engineering consultants, were notified of the availability of the draft EA through verbal or electronic mail notification.

Bernalillo County
City of Albuquerque
City of Rio Rancho
Defenders of Wildlife
Forest Guardians
Jemez Pueblo
Middle Rio Grande Council of Governments
Middle Rio Grande Conservancy District
New Mexico Audubon Council

New Mexico State University, Water Resources Research Institute
Pueblo of Santa Ana
Pueblo of Zia
Rio Grande Compact Commissioners (from CO, NM, and TX)
Rio Grande Restoration
Sandia Pueblo
San Felipe Pueblo
Sandoval County
Sierra Club
State of New Mexico, Dept. of Game and Fish
State of New Mexico, Environment Department
State of New Mexico, Interstate Stream Comm.
State of New Mexico, Minerals and Natural Resources Department
State of New Mexico, Office of Cultural Affairs, Historic Preservation Division,
State of New Mexico, State Engineers Office
State of New Mexico, State Historic Preservation Officer
Southwestern Environmental Center
Town of Bernalillo
U.S. Army Corps of Engineers, Albuquerque District Regulatory Branch
U.S. Bureau of Indian Affairs,, Southern Pueblos Agency
U.S. Bureau of Reclamation, Albuquerque Area Office
U.S. Bureau of Reclamation, Regional Area Office
U.S. Environmental Protection Agency, Region 6
U.S. Fish and Wildlife Service, New Mexico State Ecological Services Office
U.S. Geological Survey, New Mexico Water Resources Office
U.S. Geological Survey, Biological Resources Division, Jemez Mountains Research Station
U.S. Natural Resources Conservation Service, New Mexico State Office

All comments and requests for copies of the FONSI and Final EA should be directed to: Champe Green, U.S. Army Corps of Engineers, 4101 Jefferson Plaza NE, Albuquerque, NM 87109; **Phone** 505-342-3357 or 342-3353, **or by e-mail**: champe.b.green@usace.Army. mil, **or by FAX**: 505-342-3668.

8. REFERENCES

Academic Press, Inc. 1997. Archaeology of the Southwest. Second Ed. Academic Press, Inc. San Diego.

Acklen, John C., Sean H. Simpson, and Toni R. Goar. 1998. Cultural Resource Survey of the Master Business Lease Expansion at the Pueblo of Santa Ana, Sandoval County, New Mexico. TRC Project Number 24412. NMCRIS Number 61107. Albuquerque.

Acklen, John C. and Jim A. Railey. 1998. Addendum to the Cultural Resource Survey of the Master Business Lease Expansion at the Pueblo of Santa Ana, Sandoval County, New Mexico. TRC Mariah Report No. 24412 (NMCRIS Report No. 64640). Prepared by TRC Mariah Associates, Inc. Prepared for the Pueblo of Santa Ana.

Anschuetz, Kurt F., Glenda Deyloff, Weatherbee B. Dorshow, and William J. Whatley. 1995. Cultural Resources Survey of Lines 1, 2, and 3 within the Vastar Resources, Inc., New Mexico 2D-Seismic Project Area, near Zia Pueblo, Santa Ana Pueblo, and Jemez Pueblo, Sandoval County. Research Series Number 358 d. Southwest Archaeological Consultants. Santa Fe, NM.

Bayer, Laura, with Floyd Montoya and the Pueblo of Santa Ana. 1994 Santa Ana: The People, the Pueblo, and the History of Tamaya. University of New Mexico Press. Albuquerque.

Biota Information System of New Mexico. 2002. New Mexico Game and Fish Department, Santa Fe, NM. March 2002.

Bradley, Ronna J., and Kenneth L. Brown. 1998. Cultural Resources Along the MAPCO Four Corners Pipeline: Huerfano Station, New Mexico, to Hobbs Station, Texas. OCA-UNM Report No. 185-547 B, Volume 1 (NMCRIS Number 48969). Office of Contract Archaeology, University of New Mexico. Albuquerque. Prepared for Mid America Pipeline Company.

Brown, Kenneth L., ed. 1999. Data Recovery Along the 1995 MAPCO Four Corners Pipeline: Artifact Analysis for Sites in the Jemez and Las Huertas Drainages, Sandoval county, New Mexico. OCA-UNM Report No. 185-547 D, Volume 4 (NMCRIS Number 75373). Office of Contract Archaeology, University of New Mexico. Albuquerque. Prepared for Mid America Pipeline Company.

Byszewski, Berenika. 2003. Cultural Resources Assessment of Proposed Erosion Control Measures for the 2003 Rio Jemez Weir Access Road Project; An Addendum to A Cultural Resources Assessment of Approximately 70 Acres for the Weir and Access Road at Pueblo of Santa Ana, Sandoval County, New Mexico. Earth Analytic Research Report EA97 (NMCRIS Report No. 83217). Prepared by Earth Analytic, Inc. (May 1, 2003). Submitted to Pueblo of Santa Ana, Department of Natural Resources.

Condie, Carol J. 1993. An Archeological Survey of New Mexico's Proposed BA to Rio Rancho 115KV Transmission Line Corridor on Bureau of Land Management, Santa Ana Pueblo, and Private Lands in Sandoval County, New Mexico. Quivira Research Center Report No. 232 (NMCRIS Report No. 47408). Prepared by Quivira Research Center/Associates. Prepared for Metric Corporation.

Cordell, Linda S. 1979. Cultural Resources Overview: Middle Rio Grande Valley, New Mexico. Bureau of Land Management, New Mexico State Office, Santa Fe and USDA Forest Service, Southwestern Region, Albuquerque.

Cordell, Linda S. 1984. Prehistory of the Southwest. School of American Research. Academic Press, Inc. San Diego.

Cordell, Linda S. 1997. Archaeology of the Southwest. Second Ed. Academic Press, Inc. San Diego.

Dick-Peddie, W.A. 1993. New Mexico Vegetation – Past, Present, and Future. University of New Mexico Press, Albuquerque. 244 pp.

Dorshow, Wetherbee Bryan, and David Barz. 2002. The Rio Jemez Reservoir Delta and Access Road Survey, An Addendum to: A Cultural Resources Assessment of Areas to be Impacted by the Rio Jemez WHIP Project at the Pueblo of Santa Ana, Bernalillo County, New Mexico. Research Report EA 41B (NMCRIS Number 77562; Addemdum to Report EA41A [NMCRIS No. 75692]). Prepared by Earth Analytic, Inc. Submitted to Pueblo of Santa Ana, Department of Natural Resources.

Duncan, Kenneth Y., Berenika Byszewski, William Penner, and Wetherbee Dorshow. 2003. A Cultural Resources Assessment of Approximately 65 Acres for Proposed Fence Lines and Road Improvement Projects on Lands within the Pueblo of Santa Ana, Sandoval County, New Mexico. Earth Analytic Research Report EA85 (NMCRIS Report No. 81817). Prepared by Earth Analytic, Inc. (May 7, 2003). Submitted to Pueblo of Santa Ana, Department of Natural Resources.

Enloe, James G. An Archaeological Clearance Survey: Public Service Company WW to Northbulk Right-of-Way. UNM-OCA Report No. 101-103U (NMCRIS Report No. 617). Prepared by the University of New Mexico, Office of Contact Archaeology. Prepared for Public Service Company of New Mexico, Environmental Services.

Everhart, Gregory D. 2001. A Cultural Resources Inventory of 29.2 Acres for Riparian and Wetland Restoration, Pueblo of Santa Ana Reservation, New Mexico. COE Report Number 01-03 (NMCRIS Number 74826). U.S. Army Corps of Engineers, Albuquerque District. Albuquerque. Submitted to Pueblo of Santa Ana, Department of Natural Resources.

Everhart, G. D. 2002 Documentation Regarding the Rock Quarry near Jemez Canyon Dam, Pueblo of Santa Ana Reservation, New Mexico. COE Report No. 02-03 (NMCRIS Report No. 78319). U.S. Army Corps of Engineers, Albuquerque District. Albuquerque. Submitted to Pueblo of Santa Ana, Department of Natural Resources.

Frizell, Jon P. and John C. Acklen. 1987. Cultural Resource Survey of a Proposed Sand and Gravel Quarry, Sandoval County, New Mexico. (NMCRIS Report No. 18211). Prepared by TRC Mariah Associates, Inc. Prepared for Albuquerque Sand and Gravel Company.

Hammack, Laurens C. 1981. Cultural Resource Inventory Shell CO2 Mainline. NMCRIS Number 58. Complete Archaeological Service Association. Prepared for Woodward-Clyde International Americas.

Harrill, Bruce. 1984. Cultural Resources Survey: Proposed Gravel Pit Expansion on Santa Ana Pueblo Lands. (NMCRIS Report No. 28361). Prepared by the U.S. Bureau of Indian Affairs, Albuquerque Area Office.

Larralde, Signa.1999. A Rip-rap Quarry and Stockpile on Santa Ana Pueblo Lands near Jemez Dam, Sandoval County, New Mexico. Report No. AAO-00-02 (NMCRIS Report No. 66411). U.S. Bureau of Reclamation, Albuquerque Area Office. Albuquerque.

Larralde, Signa. 2000. Cultural Resources Inventory of Two Access Roads and Other Facilities for the Santa Ana River Restoration Project on Santa Ana Pueblo Lands and Private Lands, Sandoval County, New Mexico. Report No. AAO-00-018 (NMCRIS Report No. 71922). U.S. Bureau of Reclamation, Albuquerque Area Office. Albuquerque.

Leedshill-Herkenhoff, Inc. 1984. Project Modification for Sedimentation Control, Jemez Canyon Dam. Feasibility study prepared for the U.S. Army Corps of Engineers, Albuquerque District.

Morrison, J. L. 1992. Persistence of the meadow jumping mouse, ZAPUS HUDSONIUS LUTEUS, in New Mexico. Southwest. Nat. 37:308-311.

New Mexico Environment Department (NMED). 1997. New Mexico Air Quality 1994-1996. NMED Air Quality Bureau, Santa Fe, NM.

New Mexico Office of Cultural Affairs. 2001. Historic Preservation Division. Programs: State Register of Cultural Properties. http://museums.state.nm.us/hpd/

New Mexico Rare Plant Technical Council. 1999. New Mexico Rare Plants. Albuquerque, NM: New Mexico Rare Plants Home Page. http://nmrareplants.unm.edu (Version 15 March 2002).

New Mexico Water Quality Control Commission (NMWQCC). 1995. State of New Mexico Standards for Interstate and Intrastate Streams (20 NMAC 6.2).

Ortiz, Alfonso, ed. 1979. Handbook of North American Indians, Southwest. Vol. 9. Smithsonian Institution. Washington, D.C.

Penner, William, Berenika Byszewski, and Wetherbee Bryan Dorshow. 2001. A Cultural Resources Assessment of Three Parcels on Santa Ana Mesa and One Parcel in the Rio Grande Bosque at the Pueblo of Santa Ana, Bernalillo [sic, Sandoval] County, New Mexico. Earth Analytic Research Report EA 31 (NMCRIS Report No.74302). Prepared by Earth Analytic, Inc. Submitted to Pueblo of Santa Ana, Department of Natural Resources.

Penner, William, Brenda Baletti, Berenika Byszewski, and Wetherbee Bryan Dorshow. 2001. A Cultural Resources Assessment of Areas to be Impacted by the Rio Jemez WHIP Project at the Pueblo of Santa Ana, Sandoval County, New Mexico. Earth Analytic Research Report EA41a (NMCRIS Report No. 75692). Prepared by Earth Analytic, Inc.

Penner, William, Berenika Byszewski, and Wetherbee Bryan Dorshow. 2001. A Cultural Resources Assessment of Three Parcels on Santa Ana Mesa and One Parcel in the Rio Grande Bosque at the

Pueblo of Santa Ana, Bernalillo County, New Mexico. Research Report EA 31. Prepared by Earth Analytic, Inc. Submitted to Pueblo of Santa Ana, Department of Natural Resources.

Penner, William, Brenda Baletti, Berenika Byszewski, and Wetherbee Bryan Dorshow. 2001. A Cultural Resources Assessment of Areas to be Impacted by the Rio Jemez WHIP Project at the Pueblo of Santa Ana, Bernalillo County, New Mexico. Research Report EA 41 [A] (NMCRIS Number 75692). Prepared by Earth Analytic, Inc. Submitted to Pueblo of Santa Ana, Department of Natural Resources.

Penner, William, Kenneth Y. Duncan, Berenika Byszewski, and Wetherbee Dorshow. 2003. A Cultural Resources Assessment of Approximately 70 Acres for the Weir and Access Road at the Pueblo of Santa Ana, Sandoval County, New Mexico. Earth Analytic Research Report EA66.01 (NMCRIS Report No. 79981). Prepared by Earth Analytic, Inc. (February 6, 2003). Submitted to Pueblo of Santa Ana, Department of Natural Resources.

Penner, William, Berenika Byszewski, Wetherbee Dorshow, and Kenneth Duncan. 2003 A Cultural Resources Assessment of 479 Acres for the Proposed 2003 Tamaya Pueblo Pond Modification Project, Pueblo of Santa Ana Reservation, Sandoval County, New Mexico. Earth Analytic Research Report EA66.02 (NMCRIS Report No. 80680). Prepared by Earth Analytic, Inc. (March 4, 2003). Submitted to Pueblo of Santa Ana, Department of Natural Resources.

Rodgers, James B. 1979. Jemez Canyon Dam Archaeological Survey, Sandoval County, New Mexico. Archaeological Report Series No. 1 (NMCRIS Number 8182). Center for Anthropological Studies. Albuquerque. Prepared for the U.S. Army Corps of Engineers, Albuquerque District. Albuquerque.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

School of American Research.1984.Prehistory of the Southwest. School of American Research. Academic Press, Inc. San Diego.

Strong, Pauline Turner. 1979. Santa Ana Pueblo. In: Handbook of North American Indians, Southwest. Alfonso Ortiz, volume ed., Vol. 9. Smithsonian Institution. Washington, D.C.

U.S. Army Corps of Engineers (USACE). 1975. Report on sedimentation in Jemez Canyon Reservoir, Rio Jemez, Rio Grande Basin, New Mexico, Resurvey of January 1975. U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, New Mexico.

U.S. Army Corps of Engineers (USACE). 1976. Final Environmental Statement – Operation and Maintenance – Jemez Canyon Dam, Rio Grande, New Mexico. U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, New Mexico.

U.S. Army Corps of Engineers (USACE). 1984. Water Control Manual – Jemez Canyon Dam and Reservoir, Rio Jemez, New Mexico. [Later revised]. U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, New Mexico.

U.S. Army Corps of Engineers (USACE). 1985. Master Flood Control Manual – Regulation Manual – Rio Grande Basin above Elephant Butte Reservoir. U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, New Mexico.

U.S. Army Corps of Engineers (USACE). 1994. Water Control Manual – Jemez Canyon Dam and Reservoir, Rio Jemez, New Mexico. U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, New Mexico.

U.S. Army Corps of Engineers, Albuquerque District (Corps). 2000. Finding of No Significant Impact and Environmental Assessment for the Partial Evacuation of the Sediment Pool at Jemez Canyon Reservoir, Sandoval County, New Mexico. Albuquerque.

U.S. Army Corps of Engineers. 2002. Documentation Regarding the Rock Quarry near Jemez Canyon Dam, Pueblo of Santa Ana Reservation, New Mexico. COE Report Number 02-03 (NMCRIS Number 78319). U.S. Army Corps of Engineers, Albuquerque District. Albuquerque. Submitted to Pueblo of Santa Ana, Department of Natural Resources.

U.S. Department of Agriculture Soil Conservation Service, USDI Bureau of Indian Affairs, and New Mexico Agricultural Experiment Station. 1977. Soil survey of Bernalillo Co. and parts of Sandoval and Valencia Cos., New Mexico.

U.S. Department of the Interior, Bureau of Reclamation. 2000. Cultural Resources Inventory of Two Access Roads and Other Facilities for the Santa Ana River Restoration Project on Santa Ana Pueblo Lands and Private Lands, Sandoval County, New Mexico. Report No. AAO-00-018 (NMCRIS Report No. 71922). U.S. Bureau of Reclamation, Albuquerque Area Office. Albuquerque.

U.S. Department of Interior, National Park Service. 2001. National Register of Historic Places. http://www.cr.nps.gov/nr/

U.S. Environmental Protection Agency. 1977. Guidance for assessing chemical contaminant data for use in fish advisories. Volume 2 -- Risk assessment and fish consumption limits. Office of Water Report No. EPA 823-B-97-009.

U.S. Fish and Wildlife Service. 2001. Draft Fish and Wildlife Coordination Act Report for the Jemez Canyon Reservoir, Sandoval Co., NM. December, 2001.

Walker, H.A. 2001. Southwestern Willow Flycatcher Surveys Along the Jemez Canyon Reservoir Delta, Pueblo of Santa Ana. August, 2002. USDA Forest Service, Rocky Mountain Research Station, Albuquerque, NM.

Walt, Henry J. and Michael P. Marshall. 1986a. An Archeological Survey of the Proposed George Martinez Sand and Gravel Lease on Pueblo of Santa Ana Land, Sandoval County, New Mexico. (NMCRIS Report No. 11975). Prepared by Cibola Research Consultants. Prepared for the Pueblo of Santa Ana.

Walt, Henry J. and Michael P. Marshall. 1986b. An Archeological Inventory Survey of the Proposed Santa Ana Mobile Home Park, Sandoval County, New Mexico. (NMCRIS Report No. 16015). Prepared by Cibola Research Consultants. Prepared for Southern Sandoval Investments, Ltd.

Wendorf, Fred and Erik K. Reed.1955. An Alternative Reconstruction of Northern Rio Grande Prehistory. In El Palacio. 62(5-6):131-173.

Western Regional Climate Center, Desert Research Institute 2002. website http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?nmjeme

White, Leslie A. 1942. The Pueblo of Santa Ana, New Mexico. Bulletin No. 60. Bureau of American Ethnology. Smithsonian Institution. Washington, D.C.

Appendix A
Fish and Wildlife Coordination Act Report

Appendix B

Pertinent Correspondence, Permits, Letters of Concurrence